



II^o CONGRESSO
Gruppo Interregionale
AIRO Piemonte-Liguria
Valle d'Aosta

"Aspetti clinici e tecnici
della radioterapia nei
tumori del colon-retto"

8 ottobre 2011
Castello di Grinzane Cavour

Con il patrocinio



Associazione
Italiana
Radioterapia
Oncologica



FIMRC
CNR



LILT
Lega Italiana
Lotta ai Tumori

DOSIMETRIC AND DELIVERY PARAMETERS COMPARISON OF 5-FIELDS VERSUS 7-FIELDS INTENSITY MODULATED RADIATION THERAPY IN PATIENTS WITH RECTAL CANCER UNDERGONE ADJUVANT RADIOTHERAPY

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Presidenti Onorari:
Dott. G. Marchetti
Dott.ssa F. Ozello



THE ROLE OF POST-OPERATIVE RADIOTHERAPY IN RECTAL CANCER

NCI Consensus Conference (1990): RT/CT (5-FU based) is the standard post-operative treatment for high risk patients T3-T4/N+ disease (B2-C,MAC)

Pelvic radiation therapy plus CT

Decreases local recurrence

Improve survival



POSTOPERATIVE RADIOCHEMOTHERAPY

		GITSG	NCCTG	NSABP-R01
Number of pts.		202	204	555
Surgery alone	LF (%)	24		25
	S (%)	43		43
Radiotherapy	LF (%)	20	25	16
	S (%)	52	47	41
Chemotherapy	LF (%)	27		21
	S (%)	21		53
Chemoradioth.	LF (%)	11	14	8
	S (%)	59		58



TOXICITY OF ADJUVANT RT

- Acute and late small bowel morbidity (obstruction, chronic diarrhea)
- Detrimental effect to the sphincter function: exclude the sphincter from the target if not necessary (as in mid and high rectal tumors)
- Several techniques and/or devices have been used to prevent the small bowel from falling down into the lesser pelvis (e.g. Belly Board)



IMRT may allow improvement in plan quality for treatment of rectal cancer reducing dose to organ at risk compared with 3 fields conventional radiotherapy (CRT) technique.



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CLINICAL INVESTIGATION

REDUCED ACUTE BOWEL TOXICITY IN PATIENTS TREATED WITH INTENSITY-MODULATED RADIOTHERAPY FOR RECTAL CANCER

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Mok et al. *Radiation Oncology* 2011, 6:63
<http://www.ro-journal.com/content/6/1/63>



RESEARCH

Open Access

Intensity modulated radiation therapy (IMRT): differences in target volumes and improvement in clinically relevant doses to small bowel in rectal carcinoma

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0360-3016/\$ - see front matter

Arbea et al. *Radiation Oncology* 2010, 5:17
<http://www.ro-journal.com/content/5/1/17>



METHODOLOGY

Open Access

Intensity-modulated radiation therapy (IMRT) vs. 3D conformal radiotherapy (3DCRT) in locally advanced rectal cancer (LARC): dosimetric comparison and clinical implications

Leire Arbea*, Luis Isaac Ramos, Rafael Martínez-Monge, Marta Moreno, Javier Aristu

Contents lists available at ScienceDirect

Radiotherapy and Oncology

journal homepage: www.thegreenjournal.com



Original article

Bowel exposure in rectal cancer IMRT using prone, supine, or a belly board

Jasper Nijkamp^{a,1}, Barry Doodeman^{a,1}, Corrie Marijnen^b, Andrew Vincent^c,
Corine van Vliet-Vroegindeweij^{a,*}

Radiotherapy and Oncology xxx (2011) xxx–xxx

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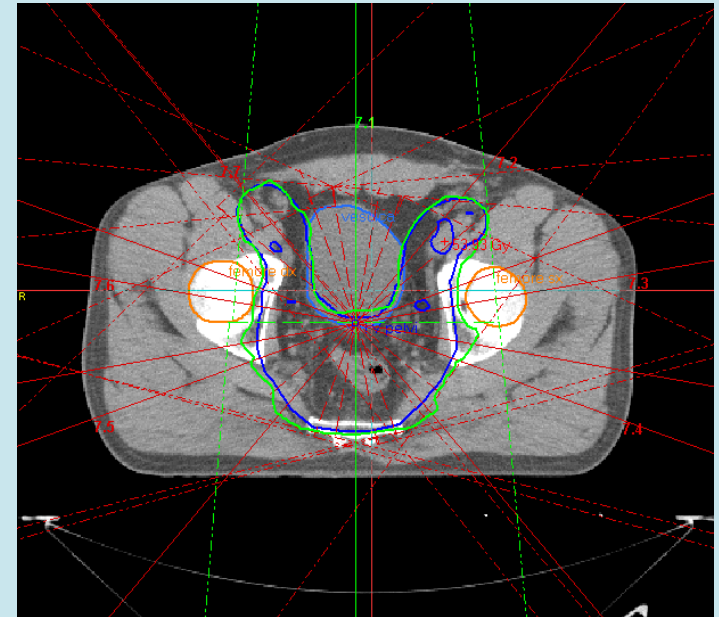


PATIENTS CHARACTERISTICS

PTS	Age	Sex	Surgery	pTNM	Stage Aster-Coller	RT/CT
1	49	M	AR	pT2pN1	C1	Sequential
2	67	M	AR	pT3pN1	C2	Sequential
3	71	M	AR	pT3pN1	C2	Sequential
4	75	M	AR	pT4pN1	C3	Sequential
5	65	M	AR	pT3pN1	C2	Sequential
6	53	M	AR	pT2pN1	C1	Sequential
7	71	M	AR	pT4pN0	B3	Sequential
8	51	F	AR	pT4pN1	C3	Sequential

IMRT PLANNING

- “Step & Shoot” IMRT(Oncentra Masterplan, v.3.3, Nucletron)
- Supine position
- 10-MV photons
- 7 coplanar fields:** 0°-40°-80°-110°-250°-280°-320°
- Segments: **70**
- Total dose to PTV 50.4 Gy/1.8 Gy die/28 fr.





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Radiotherapy and Oncology xxx (2011) xxx-xxx

Contents lists available at SciVerse ScienceDirect

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journal homepage: www.thegreenjournal.com

Original article

Preoperative concomitant boost intensity-modulated radiotherapy with oral capecitabine in locally advanced mid-low rectal cancer: A phase II trial [☆]

Jin-luan Li ^{a,1}, Jia-fu Ji ^{b,1}, Yong Cai ^{a,*}, Xiao-fan Li ^a, Yong-heng Li ^a, Hao Wu ^a, Bo Xu ^a, Fang-yuan Dou ^c, Zi-yu Li ^b, Zhao-de Bu ^b, Ai-wen Wu ^b, Ivan W.K. Tham ^d

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MUSAIU - S.S.D. RADIOTERAPIA S. LUIGI - ORBASSANO

File Schedule eChart Tools Code Mgmt Window Help

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SYNERGY - 28/09/2011 WED - Location Schedule

Locations: SYNERGY

Time	Patient	Activity	Status	Dept	Staff	MD	Location
7:30		campi multipli/archi	C	RO		MR	SYNERGY
7:45		IMRT	B	RO		MR	SYNERGY
8:15		campi multipli/archi	C	RO		MR	SYNERGY
8:30		teleterap con elettr	B	RO		MR	SYNERGY
8:45		campi multipli/archi	C	RO		MR	SYNERGY
9:00		IMRT	C	RO		MR	SYNERGY
9:15		teleterap con elettr	C	RO		MR	SYNERGY
9:30		campi multipli/archi	C	RO		MR	SYNERGY
9:45		campi multipli/archi	C	RO		MR	SYNERGY
10:00		campi multipli/archi	C	RO		MR	SYNERGY
10:15		IMRT	B	RO		MR	SYNERGY
10:30		teleterap con elettr	C	RO		MR	SYNERGY
10:45		teleterap con elettr	C	RO		MR	SYNERGY
11:00		campi multipli/archi	C	RO		MR	SYNERGY
11:15		IMRT	C	RO		S. A	SYNERGY
11:30		IMRT	C	RO		S. A	SYNERGY
11:45		campi multipli/archi	C	RO		MR	SYNERGY
12:00		campi multipli/archi	C	RO		MR	SYNERGY
12:15		IMRT	C	RO		GM	SYNERGY
12:30		campi multipli/archi	C	RO		MR	SYNERGY
12:45		IMRT	C	RO		MR	SYNERGY
13:00		IMRT	C	RO		MR	SYNERGY
13:15		campi multipli/archi	C	RO		GM	SYNERGY
13:30		IMRT	C	RO		MR	SYNERGY
13:45		IMRT	C	RO		MR	SYNERGY
14:00		campi multipli/archi	C	RO		MR	SYNERGY
14:15		campi multipli/archi	OC	RO		GM	SYNERGY
14:30		campi multipli/archi	C	RO		S. A	SYNERGY
14:45		campi multipli/archi	C	RO		MR	SYNERGY
15:00		campi multipli/archi	C	RO		MR	SYNERGY
15:15		IMRT	C	RO		MR	SYNERGY
15:30		campi multipli/archi	C	RO		S. A	SYNERGY
15:45		flash	C	RO		MR	SYNERGY
16:15		flash	FC	RO		GM	SYNERGY
16:30		flash	C	RO		MR	SYNERGY

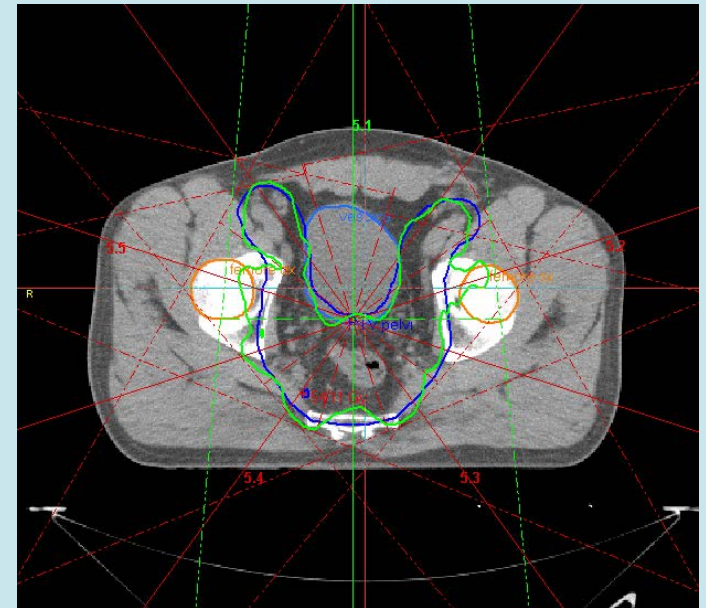
30% IMRT

PURPOSE OF THIS STUDY

To evaluate in 8 patients, in term of dosimetric parameters and delivering treatment time, the differences between two IMRT plans, 5 fields vs 7 fields

IMRT RIVAL PLANS

- ❑ “Step & Shoot” IMRT (Oncentra Masterplan, v.3.3, Nucletron)
- ❑ 10-MV photons
- ❑ **5 coplanar fields:** 0° - 72° - 144° - 216° - 288°
- ❑ Segments: **50**
- ❑ Total dose to PTV 50.4 Gy/1.8 Gy die/28 fr.

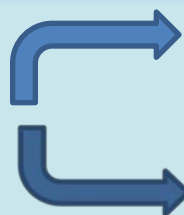




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We evaluated:



dosimetric data (PTVs coverage, OAR DVH, CI, HI)

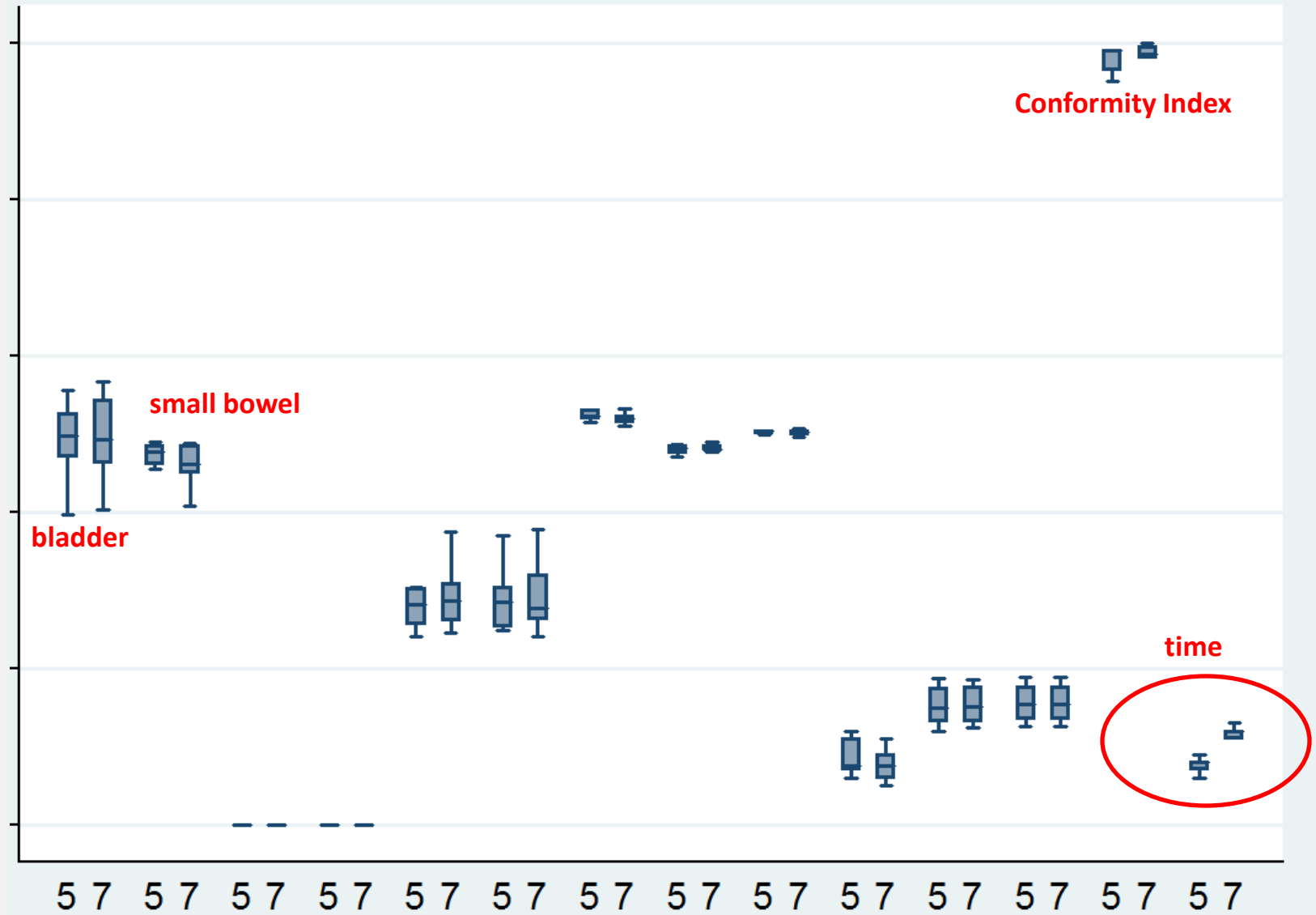
delivery treatment time

		paz 1		paz 2		paz 3		paz 4		paz 5		paz 6		paz 7		paz 8	
		5 fields	7 fields	5 fields	7 fields	5 fields	7 fields	5 fields	7 fields	5 fields	7 fields	5 fields	7 fields	5 fields	7 fields	5 fields	7 fields
BLADDER	V40 < 60%	50	47	52	56,7	49	49	53	53	55,5	55,5	49,4	49,6	39,6	40,2	45	45,5
SMALL BOWELS	Dmax 45-50 Gy	48	40,8	46,6	44,9	48,9	48,8	48,8	48,8	47,4	46,4	48	48,1	45,4	45,2	45,7	45,7
FEMORAL HEADS	dx V50 < 5%	0	0	0	0	0	0	1,4	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0
	dx D average = 40-45 Gy	27	26	30	30	26,7	24,6	30	31	37,5	37,5	24,1	26,1	29,3	30,5	24,6	27,1
		25	24	30	28	27,2	26	31	33	36,9	37,7	24,8	26,4	29,7	30,7	25,5	27,2
PTV	D2%	53	52	53	52,5	51,9	51,9	52	51,6	52,1	51,3	51,4	50,9	52,9	53,2	52,3	52
	D98%	47	48	48	47,9	48,4	48,6	48,56	48,9	48,4	48,3	48,2	48,1	47,6	47,7	48,2	48
	D50% = D average	50	50	50	50,4	50,2	50,4	50,4	50,4	50,3	49,8	49,9	49,6	50,4	50,7	50,3	50
	HI = (D2%-D98%)/D50%	0,12	0,09	0,11	0,09	0,07	0,07	0,07	0,05	0,07	0,06	0,06	0,06	0,11	0,11	0,08	0,08
	V95% (cm3)	1434	1476	1199	1233	1670	1684	1829	1843	1870,6	1859,6	1289,1	1279,7	1338,8	1358,5	1553,3	1533
	VPTV (cm3)	1508	1508	1251	1251	1687	1687	1841	1841	1880,6	1880,6	1304,2	1304,2	1386,1	1386,1	1569,4	1569,4
	CI = V95/VPTV	0,95	0,98	0,96	0,99	0,99	1,00	0,99	1,00	0,99	0,99	0,99	0,98	0,97	0,98	0,99	0,98
	minutes	7	12	8	12	6	11	8	11	9	13	8	12	8	13	9	14

RESULTS

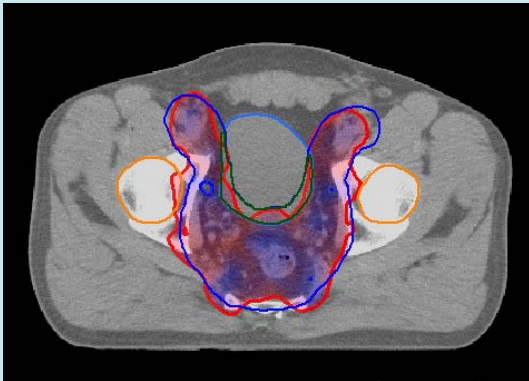
ORGAN / PARAMETER	VALUE/ OBJECTIVE	MEAN 5 fields / 50 seg	MEAN 7 fields / 70 seg
Bladder	$V_{40} < 60\%$	49.2	49.6
Small bowel	$D_{\max (2\%)} = 45 \div 50 \text{ Gy}$	47.4	46.1
Femoral heads	$V_{50} < 5\%$	0.4	0
	$D_{\text{average}} = 40 \div 45 \text{ Gy}$	28.7	29
PTV	$D_{2\%}$	52.3	52
	$D_{98\%}$	48	48.1
	$D_{\text{average}} = D_{50\%} = 50.4 \text{ Gy}$	50.3	50.2
	$HI = (D_{2\%} - D_{98\%}) / D_{50\%} \rightarrow 0$	0.09	0.08
	V_{95}	1523	1533
	V_{PTV}	1553	1553
	$CI = V_{95} / V_{\text{PTV}} \rightarrow 1$	0.98	0.99
Delivery time (minutes)	As short as possible.....	7.2	12.8

ANOVA



CONCLUSIONS

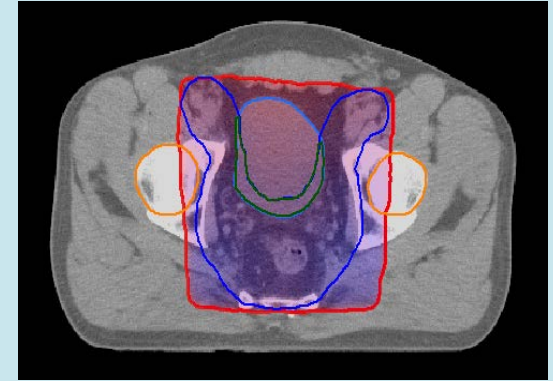
5-fields IMRT



7-fields IMRT



3D-CRT



- ❑ IMRT compared to 3D-CRT can reduce dose to the normal structure
- ❑ 5-fields IMRT maintain similar tumor coverage and dose sparing to the adjacent critical structures compared to 7 beams IMRT plans
- ❑ Delivery treatment time is significantly reduced
- ❑ After this preliminary data we decided, previous clinical evaluation of dose distribution, to offer 5-fields IMRT in adjuvant setting for rectal cancer patients



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Grazie per l'attenzione!